



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 1000-R3
UNIQUE ID NUMBER: 02P23RR138
COMBUSTOR: Phase5 Tiled
ENGINE TYPE: TF
BYPASS RATIO (-): 8.9
PRESSURE RATIO π_{co} (-): 49.6
RATED OUTPUT F_{oo} (kN): 363.9

REGULATORY DATA

CHARACTERISTIC VALUES:	LTO_{mass}/F_{oo} (mg/kN)	LTO_{num}/F_{oo} (particles/kN)	NVPM MASS CONCENTRATION ($\mu\text{g}/\text{m}^3$)
LTO/ F_{oo} AND MAX nvPM _{mass}	176.0	1.64E+15	3410
AS % OF CAEP/10 LIMIT	-	-	90.4
AS % OF CAEP/11 LIMIT (InP)	50.6	39.2	
AS % OF CAEP/11 LIMIT (NT)	82.2	58.9	

MEASURED DATA

MODE	POWER SETTING (% F_{oo})	TIME minutes	FUEL FLOW kg/s	EMISSIONS INDICES*		NVPM MASS CONCENTRATION PEAK nvPM _{mass} ($\mu\text{g}/\text{m}^3$)
				EI _{mass} (mg/kg)	EI _{num} (particles/kg)	
TAKE-OFF	100	0.7	2.872	40.8	9.96E+13	
CLIMB OUT	85	2.2	2.322	58.3	1.84E+14	
APPROACH	30	4.0	0.744	84.5	8.96E+14	
IDLE	7	26.0	0.270	19.4	4.75E+14	
LTO TOTAL (kg, mg, number of particles)			1027	46063	4.28E+17	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ F_{oo} VALUES (mg/kN, particles/kN)				126.6	1.18E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				154.1	9.32E+14	2649

* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

MODE	POWER SETTING (% F_{oo})	CORRECTED EMISSIONS INDICES	
		EI _{mass_SL} (mg/kg)	EI _{num_SL} (particles/kg)
TAKE-OFF	100	43.6	1.36E+14
CLIMB OUT	85	62.7	2.53E+14
APPROACH	30	96.9	1.97E+15
IDLE	7	23.3	9.33E+14

AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	100.8	101.6	HEAT OF COMBUSTION (MJ/kg)	43.34
TEMPERATURE (K)	287.0	292.6	HYDROGEN CONTENT (%mass)	13.97
HUMIDITY (kg water/kg dry air)	0.0080	0.0090	AROMATICS CONTENT (%vol)	15.9
			NAPHTHALENE CONTENT (%vol)	0.11
			SULPHUR CONTENT (ppm by mass)	300

MANUFACTURER: Rolls-Royce plc
TEST ORGANIZATION: Rolls-Royce plc
TEST LOCATION: Derby
TEST DATES: 04/10/2018

REMARKS

1. Certification Report EDNS01000740804
2. Correction of minor error in reported nvPM data
3. The maximum EI_{mass} occurs between 30% and 85% F_{oo}
4. The maximum EI_{num} occurs between 30% and 85% F_{oo}
5. Corrected peak EI number value (fuel correction) since EEDB v30